Preliminary Sampling Results from June 28 Stormwater Runoff Event

Water Quality and Hydrology Group (ESH-18)

On June 28, 2000 a storm dropped from 0.5 to 0.8 inches of rain across much of the burned hillside west of the Los Alamos National Laboratory. The duration of the rainstorm was less than one hour. The storm produced the largest magnitudes of runoff yet seen at LANL in 2000. Significant flow occurred in Pajarito Canyon, Canon de Valle, and Water Canyons. Runoff traversed the central portion of the Laboratory and left LANL's eastern boundary in Pajarito and Water Canyons. Maximum peak discharges in these drainages were:

- Pajarito Canyon – 1020 cubic feet per second (cfs)
- Canon de Valle – 720 cfs
- Water Canyon – 840 cfs.

The Laboratory performed extensive sampling of the runoff event. The full sets of analytical results are not currently available for review. This summary discusses the general levels of radioactivity seen in the June 28 runoff, based on preliminary analytical results for a few key "indicator" measurements.

Radioactive "Indicator" or "Screening" Measurements

The Laboratory has developed the following list of key water quality measurements that (a) are relatively quick for the analytical laboratory to complete and (b) can be used to indicate the general level of radioactivity carried in the storm water:

- Gross (total) alpha activity describes the general level of alpha radiation in the waters and in the particles (ash, clay, silt, and sand) carried by the storm water. The measurement shows the total alpha activity from both naturally-occurring and Laboratory-associated radioactive materials in the water samples. Radioactive decay from isotopes such as plutonium-239 (^{239}Pu) or uranium-238 (^{238}U), if present, would contribute to the gross alpha measurement. A gross alpha measurement can only tell us the overall levels of alpha activity in a sample; it can not tell us what specific isotope is the source of the alpha activity.
- Gross beta activity describes the general level of beta radiation in the stormwater. Examples of isotopes that would contribute to the gross beta measurement, if present, include strontium-90 (^{90}Sr) and potassium-240 (^{240}K).

- Americium-241 (^{241}Am) from gamma spectroscopy provides a quick screen for relatively moderate levels of the isotope. ^{241}Am is one of the most significant isotopes posing radiological risk when ingested. The isotope is a proxy for the presence of ^{239,240}Pu as often the two isotopes are found together in Laboratory effluents and soils.
- Cesium-137 from gamma spectroscopy provides a quick screen for low levels of the isotope. ^{137}Cs is one of the more energetic radionuclides found in the environment.
- Tritium (^{3}H) is quickly measured in the analytical laboratory and is commonly found in Laboratory effluents. Tritium poses minimal health risk, but it is an excellent tracer of LANL waste streams.
- Total suspended solids (TSS) is the only non-radioactive measurement in this group. TSS is a gross indicator of how much particulate matter is carried in the storm water.

Analytical Data

The Laboratory's Storm Water Team collected water samples at a total of 11 locations. Six of the locations were in Pajarito Canyon. The samples were sent to a commercial laboratory for analyses. The analytical data for the indicator measurements are shown in the accompanying table. A brief explanation of the information presented in the table is:

- Sampling station number and name,
- Whether the sample was collected with an automated sampler or manually,
- Filtered or unfiltered sample,
- Date the sample was collected,
- Analytical result in picoCuries per liter (pCi/L) is the concentration measured in the water sample, followed by the uncertainty in the measurement and an estimate of the minimum concentration detectable by the analytical method. Analytical result in picoCuries per gram (pCi/g) is concentration measured in the particulates or sediments only.

Along the bottom of the table is some information to place these analytical data in context. The accompanying "Stormwater Sampling Frequently Asked Questions" explains the guidelines and reference values against which the data can be compared. Comparison against historical values seen before the fire is limited to Laboratory-wide historical data (1995-1999), and to Pajarito Canyon. There are no recent (1995-1999) pre-fire stormwater results for Water Canyon and Canon de Valle, due to minimal runoff seen in these canyons since the mid-1990s.

Highlights of Results

Because the available data are limited to the “indicator” measurements, the interpretation of the radiological results will be general in perspective. The major conclusions and observations are as follows:

1. All measurements of radioactivity in the June 28 storm water are well below the historical maximums seen at the Laboratory. Gross beta activities in the water samples are higher than the historical values for Pajarito Canyon. This is true for locations both upstream and downstream of the Laboratory.
2. All of the gross alpha and beta activities, cesium-137, and tritium measurements are below DOE guidelines for public exposure. One value for americium-241 at the Laboratory’s eastern boundary in Pajarito Canyon exceeded the DOE guideline by a factor less than 2. Because the guideline assumes a year-around exposure to the water, the levels appear to be of limited concern. Owing to the screening nature of this analysis there is uncertainty in these results and they will need to be confirmed with the more detailed isotopic analyses to come.
3. Most (typically 2/3rds) of the radioactivity in the unfiltered water samples is associated with the particulates and sediment (ash, clay, silt, etc.) carried by the runoff, rather than dissolved in the water.
4. Stream sediments carried from the hillslopes west of the Laboratory may contain fallout-derived or naturally-occurring radionuclides in concentrations elevated from pre-fire levels. Cesium-137 activities in sediments carried by the June 28 runoff, for example, are elevated by about 3 to 5 times above levels previously measured in background Pajarito Plateau stream sediments. The cause may be differences in texture in the particles carried by the post-fire runoff.